

WHAT IS CLAIMED IS:

1 1. A process for fabricating a semiconductor device comprising the steps of:
2 providing a semiconductor substrate;
3 forming a silicon nitride layer overlying the substrate;
4 deposition a layer of polycrystalline silicon overlying the silicon nitride layer;
5 forming an anti-reflective coating overlying the layer of polycrystalline silicon, the anti-
6 reflective coating comprising a first layer of oxide and a second layer of silicon oxynitride
7 overlying the first layer;
8 pattern etching the anti-reflective coating, the layer of polycrystalline silicon and the
9 silicon nitride layer;
10 removing the remaining layer of silicon oxynitride by etching in hot phosphoric acid
11 before subjecting the layer of silicon oxynitride to any temperature greater than about 400°C.

2. The process of claim 1 wherein the step of pattern etching comprises:
 forming a patterned structure having an edge and a top; and
 forming a layer of insulator on the edge prior to the step of removing the remaining anti-
reflective coating.

1 3. The process of claim 2 wherein the step of forming a layer of insulator comprises
2 the steps of:
3 depositing a layer of insulator overlying the patterned structure and the edge thereof;
4 etching the layer of insulator to remove the insulator from the top of the patterned
5 structure to expose the anti-reflective coating thereon and leaving at least a portion of the layer of
6 insulator on the edge.

4. The process of claim 3 wherein the step of etching the layer comprises etching by reactive ion etching.

5. The process of claim 3 wherein the step of depositing a layer comprises depositing a layer of silicon oxide by chemical vapor deposition from a TEOS source.

6. The process of claim 1 wherein the step of forming an anti-reflective coating comprises the step of depositing a thin layer of silicon oxide by chemical vapor deposition from a TEOS source.

7. The process of claim 1 wherein the step of forming an anti-reflective coating comprises the step of depositing a layer of silicon oxynitride by plasma enhanced chemical vapor deposition from reactants N_2O and SiH_4 .

8. The process of claim 7 wherein the ratio of SiH_4 to N_2O reactants is maintained at about 1.22:1.

9. The process of claim 7 wherein the ratio of SiH_4 to N_2O reactants is maintained in the range of about 0.9-1.5:1

- 1 10. A process for etching silicon oxynitride which comprises the steps of:
2 depositing a layer of silicon oxynitride overlying a substrate;
3 forming an etch resistant pattern overlying the silicon oxynitride; and
4 etching the silicon oxynitride in a phosphoric acid etchant without subjecting the silicon
5 oxynitride to any temperature greater than about 400°C between the steps of depositing and
6 etching.

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11. An anti-reflective coating for patterning a layer on a semiconductor device comprising:

a first layer of deposited oxide; and

a second layer of silicon oxynitride overlying the first layer.

12. The anti-reflective coating of claim 11 wherein the second layer of silicon oxynitride is characterized by a thickness of about 26nm and an extinction coefficient of about 0.03 ± 0.003 .

13. The anti-reflective coating of claim 10 wherein the first layer has a thickness of about 7.5nm to about 10nm and the second layer has a thickness of about 24nm to about 30nm.

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1 14. A process for fabricating a semiconductor device comprising the steps of:
2 depositing a first layer of oxide to a thickness of between about 7.5nm and 10nm by
3 chemical vapor deposition from a TEOS source;
4 depositing a second layer of silicon oxynitride overlying the first layer to a thickness of
5 between about 25nm and about 30nm by plasma enhanced chemical vapor deposition;
6 patterning the first and second layers; and
7 etching the second layer in an etchant comprising hot phosphoric acid, the etching
8 occurring before the second layer is subjected to any temperature greater than about 400°C.

15. The process of claim 14 wherein the step of depositing a second layer of silicon oxynitride comprises depositing a layer from reactants comprising N_2O and SiH_4 and controlling the ratio of reactants to vary the extinction coefficient of the second layer.

16. The process of claim 15 wherein the ratio of reactants (SiH_4 to N_2O) is controlled to about 0.9-1.5:1.

17. The process of claim 16 wherein the ratio of reactants is controlled to about 1.22:1.

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